Abstracts

Inverse scattering using the finite-element method and a nonlinear optimization technique

I.T. Rekanos, T.V. Yioultsis and T.D. Tsiboukis. "Inverse scattering using the finite-element method and a nonlinear optimization technique." 1999 Transactions on Microwave Theory and Techniques 47.3 (Mar. 1999 [T-MTT]): 336-344.

A new spatial-domain technique for the reconstruction of the complex permittivity profile of unknown scatterers is proposed in this paper. The technique is based on a combination of the finite-element method (FEM) and the Polak-Ribiere nonlinear conjugate gradient optimization algorithm. The direct scattering problem is explicitly dealt with by means of the differential formulation and it is solved by applying the FEM. The inversion methodology is oriented to minimizing a cost function, which consists of a standard error term and regularization term. A sensitivity analysis, which is carried out by an elaborate finite-element procedure, results in the determination of the direction required for correcting the profile. Significant reduction of the computation time is obtained by introducing the adjoint state vector methodology. The efficiency of the presented inversion technique is validated by applying it to the inversion of synthetic scattered far-field measurements, which are corrupted by additive noise.

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